CLAIMS

What is claimed is:

1. An electrical circuit apparatus comprising;

a substrate comprising a top side, a ground layer, at least one thermal aperture, and at least one solder aperture;

a heat sink; and

an adhesive layer for mechanically coupling said heat sink to the ground layer of said substrate such that at least a portion of said at least one substrate thermal aperture overlaps said heat sink, said adhesive layer comprising at least one thermal aperture and at least one solder aperture, wherein aligning the at least one substrate solder aperture with the at least one adhesive layer solder aperture and aligning the at least one substrate thermal aperture with the at least one adhesive layer thermal aperture enables solder wetting in a predetermined area between said heat sink and the ground layer of said substrate.

2. The apparatus of Claim 1 further comprising a device coupled to the top side of said substrate such that at least a portion of said device covers at least a portion of said at least one substrate thermal aperture, and wherein said device is coupled to said heat sink via at least a portion of said at least one substrate thermal aperture.

3. The apparatus of Claim 2, wherein said device comprises at least one input terminal and a ground flange, and at least a portion of said predetermined area is located beneath the ground flange of said device.

4. The apparatus of Claim 2, wherein said heat sink has a coefficient of thermal expansion that is essentially matched to that of said device.

5. The apparatus of Claim 2, wherein said device is a ceramic device.

6. The apparatus of Claim 2, wherein said device is coupled to said substrate and said heat sink and said solder wetting occurs during a single pass solder reflow process.

7. The apparatus of Claim 6, wherein said solder reflow process uses a no-lead solder.

8. The apparatus of Claim 6, wherein said solder reflow process uses a leaded solder.

9. The apparatus of Claim 1, wherein said adhesive layer comprises an electrically non-conducting material.

10. The apparatus of Claim 9, wherein said electrically non-conductive material is acrylic.

11. The apparatus of Claim 1, wherein said substrate is an organic circuit board.

12. The apparatus of Claim 1, wherein said adhesive layer has a predetermined thickness.

13. The apparatus of Claim 1, wherein said adhesive layer further comprises at least one venting aperture located on a predetermined area of said adhesive layer to enable the escape of solder volatiles during solder reflow.

14. The apparatus of Claim 13, wherein said predetermined area is adjacent to said adhesive layer thermal aperture.

15. An electrical circuit apparatus comprising;

a substrate comprising a top side, a ground layer, at least one thermal aperture, and at least one solder aperture;

a heat sink;

an adhesive layer for mechanically coupling said heat sink to the ground layer of said substrate such that at least a portion of said at least one substrate thermal aperture overlaps said heat sink, said adhesive layer comprising at least one thermal aperture and at least one solder aperture; and

a device coupled to the top side of said substrate such that at least a portion of said device covers at least a portion of said at least one substrate thermal aperture, and wherein said device is coupled to said heat sink via at least a portion of said at least one thermal aperture, and wherein aligning the at least one substrate solder aperture with the at least one adhesive layer solder aperture and aligning the at least one substrate thermal aperture with the at least one adhesive layer solder aperture enables solder wetting in a predetermined area between said heat sink and the ground layer of said substrate, and wherein at least a portion of said predetermined area is located beneath said device.

16. An electrical circuit apparatus comprising;

an organic circuit board comprising a top side, a ground layer, at least one thermal aperture, and at least one solder aperture;

a heat sink;

an adhesive layer for mechanically coupling said heat sink to the ground layer of said substrate such that at least a portion of said at least one substrate thermal aperture overlaps said heat sink, said adhesive layer having a predetermined thickness and comprising at least one thermal aperture, at least one solder aperture and at least one venting aperture adjacent to the at least one adhesive layer thermal aperture; and

a device comprising at least one input terminal and a ground flange and coupled to the top side of said substrate such that at least a portion of said device covers at least a portion of said at least one substrate thermal aperture, and wherein said device is coupled to said heat sink via at least a portion of said at least one substrate thermal aperture, and wherein aligning the at least one substrate solder aperture with the at least one adhesive layer solder aperture and aligning the at least one substrate thermal aperture with the at least one adhesive layer thermal aperture enables solder wetting in a predetermined area between said heat sink and the ground layer of said substrate, and wherein at least a portion of said predetermined area is located beneath the ground flange of said device.

17. A method for assembling an electrical circuit apparatus comprising a substrate having a top side, a ground layer, at least one thermal aperture, and at least one solder aperture, a heat sink, and an adhesive layer having at least one thermal aperture and at least one solder aperture, said method comprising the steps of:

a) aligning the at least one substrate solder aperture with the at least one adhesive layer solder aperture and aligning the at least one substrate thermal aperture with the at least one adhesive layer thermal aperture;

b) mechanically coupling said heat sink to the ground layer of said substrate using said adhesive layer such that at least a portion of said at least one substrate thermal aperture overlaps said heat sink;

c) filling at least a portion of said at least one adhesive layer solder aperture and at least a portion of said at least one substrate thermal aperture with solder; and

d) performing a process for solder wetting, wherein the aligning of the at least one substrate solder aperture with the at least one adhesive layer solder aperture and the aligning of the at least one substrate thermal aperture with the at least one adhesive layer thermal aperture causes said solder to flow from the at least one adhesive layer solder aperture to a predetermined area between said heat sink and the ground layer of said substrate.

18. The method of Claim 17, wherein said electrical circuit apparatus further comprises a device, and wherein said method further comprises the step after step c) of mounting said device onto the topside of said substrate such that at least a portion of said device covers at least a portion of said at least one substrate thermal aperture and such that said device is coupled to said heat sink via at least a portion of said at least one substrate thermal aperture.

19. The method of Claim 18, wherein said device is coupled to said substrate and said heat sink and said solder wetting occurs during a single pass solder reflow process.

20. The method of Claim 19, wherein said solder reflow process uses a no-lead solder.

21. The method of Claim 19, wherein said solder reflow process uses a leaded solder.

22. The method of Claim 17, wherein at least a portion of the steps of said method are performed as part of an automated process.

23. The method of Claim 17, wherein at least a portion of the steps of said method are performed manually.

24. An electrical circuit apparatus comprising;

a substrate comprising a top side, a ground layer, and at least one solder aperture;

a heat sink; and

an adhesive layer for mechanically coupling said heat sink to the ground layer of said substrate, said adhesive layer comprising at least one solder aperture, wherein aligning the at least one substrate solder aperture with the at least one adhesive layer solder aperture enables solder wetting in a predetermined area between said heat sink and the ground layer of said substrate.

25. The apparatus of Claim 24 further comprising a device coupled to the topside of said heat sink.

26. The apparatus of Claim 25, wherein at least a portion of said predetermined area is located beneath said device.

27. The apparatus of Claim 25, wherein said device is coupled to said substrate and said solder wetting occurs during a single pass solder reflow process.

28. The apparatus of Claim 27, wherein said solder reflow process uses a no-lead solder.

29. The apparatus of Claim 27, wherein said solder reflow process uses a leaded solder.

30. The apparatus of Claim 25, wherein said device is an inductive coil.

31. The apparatus of Claim 24, wherein said adhesive layer comprises an electrically non-conducting material.

32. The apparatus of Claim 31, wherein said electrically non-conductive material is acrylic.

33. The apparatus of Claim 24, wherein said substrate is an organic circuit board.

34. The apparatus of Claim 24, wherein said adhesive layer has a predetermined thickness.

35. The apparatus of Claim 24, wherein said substrate further comprises at least one venting hole that is aligned with said at least one adhesive layer solder aperture to enable the escape of solder volatiles during said solder wetting.

36. An electrical circuit apparatus comprising;

a substrate comprising a top side, a ground layer, and at least one solder aperture;

a heat sink;

an adhesive layer for mechanically coupling said heat sink to the ground layer of said substrate, said adhesive layer comprising at least one solder aperture; and

a device coupled to the topside of said heat sink, wherein aligning the at least one substrate solder aperture with the at least one adhesive layer solder aperture enables solder wetting in a predetermined area between said heat sink and the ground layer of said substrate, and wherein at least a portion of said predetermined area is located beneath said device.

37. An electrical circuit apparatus comprising;

an organic circuit comprising a top side, a ground layer, at least one solder aperture, and at least one venting hole;

a heat sink;

an adhesive layer for mechanically coupling said heat sink to the ground layer of said substrate, said adhesive layer having a predetermined thickness and comprising at least one solder aperture; and

a device coupled to the topside of said heat sink, wherein aligning the at least one substrate solder aperture and the at least one venting hole with the at least one adhesive layer solder aperture enables solder wetting in a predetermined area between said heat sink and the ground layer of said substrate, and wherein at least a portion of said predetermined area is located beneath said device.

38. A method for assembling an electrical circuit apparatus comprising a substrate having a top side, a ground layer, and at least one solder aperture, a heat sink, and an adhesive layer having at least one solder aperture, said method comprising the steps of:

a) aligning the at least one substrate solder aperture with the at least one adhesive layer solder aperture;

b) mechanically coupling said heat sink to the ground layer of said substrate using said adhesive layer;

c) filling at least a portion of said at least one adhesive layer solder aperture with solder; and

d) performing a process for solder wetting, wherein the aligning of the at least one substrate solder aperture with the at least one adhesive layer solder aperture causes said solder to flow from said at least one adhesive layer solder aperture to a predetermined area between said heat sink and the ground layer of said substrate.

39. The method of Claim 38, wherein said electrical circuit apparatus further comprises a device, and wherein said method further comprises the step after step c) of mounting said device onto the topside of said substrate.

40. The method of Claim 39, wherein said device is coupled to said substrate and said solder wetting occurs during a single pass solder reflow process.

41. The method of Claim 40, wherein said solder reflow process uses a no-lead solder.

42. The method of Claim 40, wherein said solder reflow process uses a leaded solder.

43. The method of Claim 38, wherein at least a portion of the steps of said method are performed as part of an automated process.

44. The method of Claim 38, wherein at least a portion of the steps of said method are performed manually.

45. The method of Claim 38, wherein said substrate further comprises at least one venting hole, and step a) further comprises aligning said at least one venting hole with said at least one adhesive layer solder aperture.

46. An electrical circuit apparatus comprising;

a substrate comprising a top side, a ground layer, and at least one solder aperture;

a first heat sink having a first coefficient of thermal expansion ("CTE");

a second heat sink having a second CTE that is lower than said first CTE; and

at least one adhesive layer for mechanically coupling said heat sinks to the ground layer of said substrate, said adhesive layer comprising at least one solder aperture, wherein aligning said at least one substrate solder aperture with said at least one adhesive layer solder aperture enables solder wetting in a first predetermined area between said first heat sink and the ground layer of said substrate and in a second predetermined area between said second heat sink and the ground layer of said substrate.

47. The apparatus of Claim 46 further comprising a first device coupled to the topside of said substrate such that at least a portion of said first device overlaps said first heat sink and a second device coupled to the topside of said heat sink such that at least a portion of said second device overlaps said second heat sink and wherein the CTE of said second heat sink is essentially matched to a CTE of said second device.

48. The apparatus of Claim 47, wherein said first device is a power device, and said second device is a ceramic device.

49. The apparatus of Claim 48, wherein said first device is a radio frequency transistor, and said second device is a load resistor.